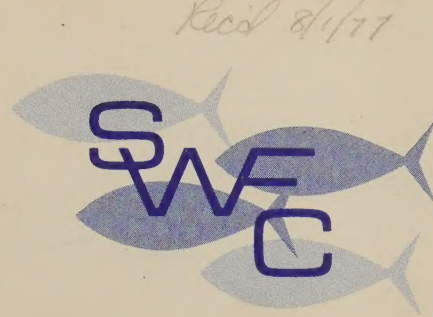




HONOLULU
LA JOLLA
MONTEREY
TIBURON

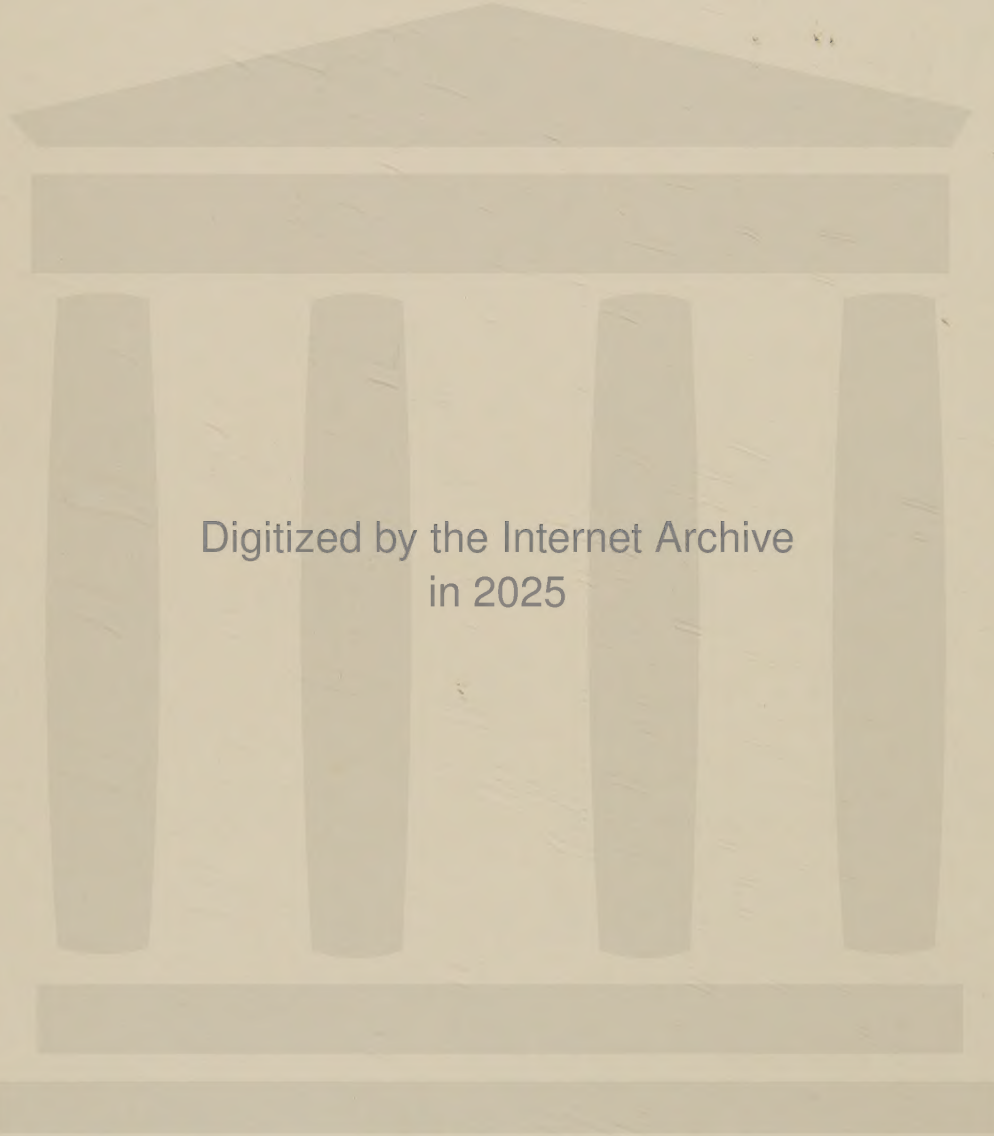


SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - APRIL 1977

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LA JOLLA, CALIFORNIA

HONOLULU LABORATORY
LA JOLLA LABORATORY
TIBURON LABORATORY

MONTHLY REPORT - APRIL 1977

STATUS OF PUBLICATIONS

Published

Leong, Roderick. 1977. Maturation and induced spawning of captive Pacific mackerel, Scomber japonicus. Fishery Bulletin, U.S. 75(1): 205-211.

Pacific mackerel, Scomber japonicus, became sexually mature under laboratory conditions and were induced to spawn with hormone injections. Fish caught before the major spawning season became mature under the natural photoperiod and under artificial photoperiods of 4 h light 20 h dark, 8 h light 16 h dark, and 16 h light 8 h dark. Mackerel caught near the end of the spawning season redeveloped their gonads more rapidly at 18°C than at 15°C or ambient temperature. A 16°C-14 h light 10 h dark environment was effective in maintaining mackerel in spawning condition beyond the normal spawning season. Any of three combinations of hormones induced spawning: gonadotropin from ground salmon pituitary followed 24 h later by gonadotropin from pregnant mare serum; human chorionic gonadotropin followed 24 h later by gonadotropin from pregnant mare serum; and salmon pituitary plus human chorionic gonadotropin followed 24 h later by salmon pituitary plus human chorionic gonadotropin plus gonadotropin from pregnant mare serum. The hormones did not induce spawning when used individually. A procedure for routine spawning of Pacific mackerel is described.

Moser, H. Geoffrey, Elbert H. Ahlstrom, and Elaine M. Sandknop. 1977. Guide to the identification of scorpionfish larvae (family Scorpaenidae) in the eastern Pacific with comparative notes on species of Sebastes and Helicolenus from other oceans. NOAA Technical Report NMFS Circular 402, 71 p.

This report does not constitute publication and is for information only.

Developmental stages of 51 species or forms of scorpionfishes are described and illustrated in this identification guide. Thirty-eight are from the eastern Pacific and represent six of the eight scorpaenid genera known from that region--Sebastes, Sebastolobus, Scorpaenodes, Scorpaena, Pontinus, and Ectreposebastes. Sebastes is the most thoroughly treated; developmental series of six species from the eastern Pacific are described and illustrated; pigment patterns of early larvae of 33 species are given and 23 of these are illustrated. Larval series of three North Atlantic species of Sebastes are described and illustrated as is a series of Sebastes from off Chile; in addition, the published information on eight northwestern Pacific species is summarized and discussed in relation to the eastern Pacific and Atlantic species. The other genera are represented by one or two species. Since larvae of the eastern Pacific species of Helicolenus were not available, a larval series of H. dactylopterus from the Atlantic are described for comparative purposes. Larvae of the eighth eastern Pacific scorpaenid genus, Trachyscorpia, are unknown.

Two dichotomous keys to the eastern Pacific genera are included, one for the early larval stages up to the initiation of notochord flexion and one for postflexion larvae. In the text, a summary of the literature and definitive characters is followed by the descriptive accounts of the species. Each species account contains a literature summary, description, set of illustrations, and information on distribution and abundance.

Jeannette W. Struhsaker. 1977. Effects of benzene (a toxic component of petroleum) on spawning Pacific herring, Clupea harengus pallasii. Fishery Bulletin, U.S. 75(1):43-49.

When female Pacific herring were exposed to low levels (parts per billion) of benzene for 48 h just prior to their spawning, a significant reduction occurred in survival of ovarian eggs and resultant embryos and larvae through yolk absorption. The reduction in survival of ovarian eggs was approximately 10-25%, for embryos from fertilization to hatching, 26%, and for embryos and larvae through yolk absorption, 43%. Exposure to benzene also induced premature spawning and resulted in aberrant swimming behavior and disequilibrium in adults of both sexes.

Compared with other life history stages, Dr. Struhsaker found that the spawning stage is clearly the most sensitive of those tested. If fishes prove generally to be most sensitive to petroleum components during their spawning seasons, fishery management decisions should take this factor into consideration in protecting the resources.

HONOLULU LABORATORY

RESOURCE ASSESSMENT AND DEVELOPMENT INVESTIGATIONS (RADI)

Preparations Made to Anchor Fish Aggregating Objects in Hawaiian Waters

Mr. Walter Matsumoto, Fishery Biologist at the Honolulu Laboratory, assisted by Dr. Donald Aasted, Fishery Methods and Equipment Specialist and Research Assistant Thomas Kazama, has been fabricating fish aggregating objects that will be put in place in Hawaiian waters on the forthcoming cruise of the Townsend Cromwell (TC-77-02). The purpose of anchoring these floating objects is to determine their usefulness in attracting and aggregating fish, particularly skipjack tuna. The project is being undertaken jointly by the Honolulu Laboratory (HL) and the Pacific Tuna Development Foundation (PTDF). The floating objects will be anchored at four different locations in waters between 100 and 540 fathoms deep. Object No. 1 will be anchored approximately 7 miles southwest of Diamond Head at lat. 21°12'N, long. 157°55'W; Object No. 2 will be placed approximately 15 miles south of Koko Head at lat. 20°01'N, long. 157°45'W; and Object No. 3, 25 miles south of Koko Head, off the southwest tip of Penguin Bank at lat. 20°51'N, long. 157°45'W. Object No. 4 will be anchored either at Peret Seamount at lat. 19°19'N, long. 157°11'W or on Cross Seamount at lat. 18°43'N, long. 158°17'W. The objects will be anchored beginning on or about May 9 and will be left in position for at least 2 years.

A letter has been sent to local sport and commercial fishermen to inform them about the aggregating objects. Mr. Matsumoto has also been speaking to various deep-sea fishing clubs about the project. The areas around Object Nos. 1-3 will be open for fishing to all fishing crafts. In return, Mr. Matsumoto hopes to obtain data on catches and fish school sightings around the aggregating objects from the fishermen.

Plans Prepared to Monitor Environment Around the Northwestern Hawaiian Islands (NWHI)

Mr. Richard Uchida, Leader, Insular Resources Task at the Honolulu Laboratory, completed drafting a station pattern for monitoring the physical and biological properties of the waters around the NWHI. These monitoring stations, which will be occupied once each quarter, will include plankton and midwater trawl hauls and XBT and chlorinity-temperature-depth (CTD) observations.

Preparations Made for Foreign Fishing Vessel Observer Program

Mr. Reginald Gooding, Fishery Biologist at the Honolulu Laboratory, has been making preparations to place Honolulu Laboratory personnel as observers on foreign fishing vessels that are expected to fish within 200

miles of the Hawaiian Archipelago. Mr. Gooding reported that the observers are standing by and are ready to board the foreign vessels. The latest information available indicates that two Japanese and four Russian trawlers will be permitted to fish the seamount (Hancock Seamount) resources. Tentatively the two Japanese vessels are scheduled to fish 12 and 13 days, respectively, and the Russian vessels 6 or 7 days each. Mr. Gooding has made arrangements with the U.S. Navy command at Midway Island to assist in getting the Honolulu Laboratory observers on and off the foreign vessels.

Meeting Held to Discuss Refurbishing
the Townsend Cromwell

Dr. Robert Skillman, as chairman of Honolulu Laboratory's Vessel Committee, reported that a meeting was held with Cdr. Merritt Walter, other members of NOS, and Honolulu staff members to produce a prioritized list of refurbishment items for the NOAA research vessel Townsend Cromwell, as follows:

1. Improve trawling capability (several major modifications).
2. Satellite navigation.
3. Redesign forward deck area for efficient trap fishing and plankton sampling.
4. Redesign scientific laboratory space (to include two laboratories, small space onstern, and portable brine/flash freezing systems).
5. Miscellaneous ship requested items (nine items including deep-sea anchoring modification, air conditioning system, mess deck).
6. Rearrange head/shower and laundry area on main deck.

* * * * *

Dr. Robert Skillman, Leader of the Resource Monitoring and Assessment Task, reported that work in the task has been centered on data processing. This work included the polishing of a summary program for the landings of the longline fishery in Pago Pago, American Samoa, a summary program for certain data from the Solomon Islands skipjack tuna fishery, and setting up data editing programs for the Samoa landings data, and data on sizes of billfishes and tunas in the Hawaiian fisheries.

Other activities of the group included the following: Mrs. Lucille Tsukano checked and keypunched the Hawaii State Fish and Game catch and bait data for the period October to December 1976, and started work sorting the Japanese longline data for information that was previously omitted. Mrs. Sally Kuba was occupied with writing a program to extract billfish

data from various data sets. Mr. Ray Sumida has completed the preliminary SOP for the NWHI cruises. The SOP is presently being typed for inhouse review. Plans are being made to hire part-time coders and keypunchers to place 350,000 to 375,000 new data records on billfish and tuna sizes from the Hawaiian fishery into Honolulu Laboratory's data management system.

* * * * *

Mr. Uchida completed contract negotiations with Captain Skip Naftel of the Easy Rider Corporation for demersal and pelagic fishing surveys in waters of the Northwest Hawaiian Islands for 2-week periods in May and June.

Other members of the Insular Resources Task were engaged in various activities. Fishery Biologist Thomas Hida worked on plans to remodel Honolulu Laboratory's warehouse that is presently being used to store biological specimens and supplies. The warehouse will be remodeled to house working areas to process plankton and trawl samples. An architect will be consulted for this work. Mr. Hida also checked out the bottom trawling gear that will be used on the forthcoming Townsend Cromwell cruise.

Research Assistants Paul Shiota and Robert Humphreys continued work on fabricating fishing gear for the NWHI cruise of the Cromwell.

Research Assistant James Uchiyama has completed processing otoliths of skipjack tuna from the Atlantic Ocean and has commenced reading the otoliths. Mr. Uchiyama also interviewed handicapped persons for otolith reader positions.

Mr. Arnold Suzumoto, Research Assistant, is continuing work in transferring Honolulu Laboratory's fish collection to the Bishop Museum.

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Dr. Jerry Wetherall and Mr. Richard Uchida participated in a briefing/information session arranged by the Western Pacific Program Office, Southwest Region, on April 19 for the captains and crews of the west coast albacore trollers Typhoon and Joann Marie. The trollers are under charter to the Pacific Tuna Development Foundation/American Fishermen's Research Foundation (PTDF/AFRF) to conduct exploratory fishing for albacore northwest of Midway Island. The vessel captains indicated they may fish as far west as long. 150°E. Also attending the briefing were representatives of the U.S. Coast Guard, the Fish and Wildlife Service, and the National Weather Service. The vessels departed Kewalo Basin on April 21.

Estimated 1977 Hawaii Landings of Skipjack Tuna Continue Above Long-Term Average

The March 28 to April 25 Hawaii landings of skipjack tuna were estimated at 297.7 metric tons (MT), which is 141.2 MT above the 1976 landings for the same period and 107.1 MT above the 1948 to 1976 long-term average.

The 1977 landings from January through April 25 were estimated at 1,123.7 MT, which is 484.3 MT above last year's catch for the same period and 583.4 MT above the 1948 to 1976 long-term average.

* * * * *

Pulou Niutoa, employee of the Government of American Samoa, recorded the lengths of 557 albacore from 12 vessels during the period from March 22 to 31. He also collected 12 sets of catch and effort data. Utilizing data from five vessels, the average size of albacore for the period was 96.3 cm and the mean catch rate averaged 2.19 albacore per 100 hooks.

FISH-ENVIRONMENT INVESTIGATIONS (FEI)

Experiments to Determine Various Behavior Patterns of Tuna Continue

Dr. Andrew Dizon, Leader of the Experimental Ecology of Tunas Task at the Honolulu Laboratory, reported that experiments to determine various behavior patterns of tunas continued during the month of April. Tests were conducted on a yellowfin tuna in an experiment designed to ascertain its capacity to physiologically thermoregulate. The fish was the first of a projected five-fish experimental series and is the first time the deep body temperature of a free-swimming yellowfin tuna has been measured. The tests consisted of continuously monitoring the activity and red muscle temperature of the fish in alternating 12-h periods of 20°, 25°, and 30°C water temperature regimes. Data from the first fish are now being analyzed.

Mr. Michael Barry continued his work on turbidity and tuna movements using kawakawa and yellowfin tuna as test animals. In general, avoidance was observed when the fish were exposed to delineated clouds of turbidity, although they would sometimes react only after partially penetrating the cloud. The yellowfin tuna was better at avoiding the clouds of turbidity and would not eat if prey capture required entrance into the turbid regions. In the yellowfin tuna experiments bottom sediments from the DOMES (Deep Ocean Mining Experimental Study) region were used to produce clouds of turbidity. The critical range of turbidities where the tuna would cease eating in the cloud was from 1.30 to 1.95 NTU (Nephelometric Turbidity Units) compared to background turbidities of 0.70 to 0.96 NTU.

Two kawakawa, tested with kaolin turbidity, were also unwilling to eat under turbid conditions but had a higher tolerance than the yellowfin tuna--approximately 3.00 NTU. Feeding efficiency is reduced in turbid water since obviously search times are longer.

An experiment was initiated during the month to determine whether weighting kawakawa with a 200-g slug to increase density would result in an increased basal swim rate. It is hoped that this can be used as a tool to study respiration and metabolism rates at more than the minimum hydrostatic

equilibrium speeds. So far attempts to persuade test animals to ingest the weighted slugs have failed. The next step will be to either force-feed or insert weighted slugs into the body cavity of the fish.

A reanalysis of old data on the effect of temperature and routine respiration rate of skipjack tuna has revealed some interesting information: 1) respiration rate is dependent upon swim speed and independent of temperature, acclimation time at temperature, and body weight; 2) however, use of swim speed and log body weight as predictors of log metabolic rate gives significantly larger multiple r^2 than any other combination of independent variables (swim speed, log weight, temperature, acclimation time), and 3) the linear relationship between speed and log weight is very similar in slope and intercept to that determined by Gooding and Neill for routine respiration rates collected entirely at 25°C. The manuscript describing this work is almost complete.

* * * * *

Mr. Heeny Yuen, Leader of the Recreational Fisheries Task, returned to Honolulu during the month after participating in the Bay of Islands Billfish Tournament in New Zealand and a visit to Fiji. At the tournament Mr. Yuen conducted a workshop on the identification of tuna and billfish which was attended by about 100 persons. Mr. Yuen obtained size data on striped marlin dating back to World War II from the records maintained by the Bay of Islands Swordfish Club. In Suva, Fiji, Mr. Yuen talked with Mr. Robert Stone, Principal Fisheries Officer, and discovered that recreational fishing was not very prevalent in Fiji.

Locally, Mr. Yuen has been contacting fishing clubs for size data on billfishes. He also spoke to the Waianae Big Game Fishing Club and the Honolulu Mosquito Trolling Club.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

ALBACORE FISHERIES PROGRAM

Collaborative Research Yields New Insights into Physiology of Albacore Tuna

Dr. R. Michael Laurs, Leader of the Albacore Fisheries Program at the La Jolla Laboratory, recently completed two papers dealing with the physiology of albacore tuna, Thunnus alalunga.

The first of these, written with Drs. David Morrison, Patricia Giclas, Betty Curry and Richard Ulevitch of the Department of Immunopathology of the Scripps Clinic and Research Foundation, titled, "The serum complement

system of the albacore tuna," is an examination of the serum hemolytic complement system of one of the higher teleosts, the albacore tuna.

These studies demonstrate that normal albacore serum possesses a number of properties characteristic of the higher vertebrates, and by at least one criterion, appears to be distinct from serum complement derived from the lower teleosts and elasmobranchii.

The second paper written with Drs. Ulevitch and Morrison, "Estimates of blood volume in the albacore tuna," is the first such study on blood volume for any species of tuna. Tunas are exceptional fishes because of the incapacity to thermoregulate. They accomplish thermoregulation by a counter-current heat exchanger system in the vascular system which permits them to achieve body temperatures greater than ambient water temperature. The present study was undertaken to estimate blood volume in albacore tuna as part of an overall objective to understand the thermoregulation process and the role it may play in determining the ecological requirements of the species.

The study resulted in findings with both physiologic and phylogenetic significance. The volume of blood in the albacore was determined to be between 8.2 and 19.7% of the weight of the fish and inversely proportional to weight. These data demonstrate that an albacore's blood volume is appreciably greater for its weight than has been reported for other teleostean fishes. The data do not support the hypothesis that large blood volume is a primitive characteristic of fishes and the authors propose that the albacore has evolved a large blood volume to meet its particular physiological requirements.

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At the La Jolla Laboratory, Ron Lynn, Oceanographer, continued to make arrangements for the June albacore-oceanography cruise aboard the NOAA research vessel, David Starr Jordan. Two members of the Office of Naval Weather Service will join the scientific crew to prepare and launch radiosondes and to process the meteorological data. The software requirements for the new calculator/system controller were established. Numerous logistical purchases were made for the calculator system and the drifter buoy study.

* * * * *

Ken Bliss, Oceanographer at the La Jolla Laboratory, completed an evening University Extension course in mini- and micro-computers last month. As part of the course he wrote a program to make tapes of oceanographic data recorded on the IBM 1800 computer compatible with the CDC 3600 computer presently in use at the University of California, San Diego.

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The generation of albacore catch-per-unit effort charts (by 1° squares of latitude and longitude) was completed by A. Majors, Fishery Biologist at the La Jolla Laboratory, this month, and distributed to U.S. west coast fishermen. The production of these charts is part of a cooperative program with state fish and game departments of California, Oregon and Washington.

LARVAL FISHES, COASTAL EASTERN PACIFIC PROGRAM

First Results Available on Bioassay Experiments with Laboratory-Produced Anchovy Larvae

Water used in bioassay experiments with laboratory-produced anchovy larvae on the March cruise of the NOAA research vessel Jordan was analyzed for species identification and enumeration by Ms. Pollock, Biological Technician at the La Jolla Laboratory. Feeding experiments with larval anchovies were performed with sea water taken from the Huntington Beach area and Santa Monica Bay. The dominant species found in the samples was a small dinoflagellate, 20 μ m in diameter. The highest density of the small dinoflagellate was 24 cells/ml. There was a large variety of both dinoflagellate and diatom species, although very few species were present in concentrations greater than 1 cell/ml.

Stomach content analysis has begun on first-feeding and 6-mm anchovy larvae used in the bioassay experiments. Approximately half of the larvae were dissected in April by Ms. Pollock. The results so far show that the 20- μ m dinoflagellate was the dominate food eaten by both age groups of larvae. Other types of food found in the guts of larvae were Peridinium sp., a silicoflagellate, 10 to 30 μ m unidentified cells, a pennate diatom (25 X 70 μ m), unidentified dinoflagellates 15 to 45 μ m in diameter and a few copepod eggs; thus it appears that the fish larvae were feeding opportunistically. The percentage of 6-mm larvae which fed during the 4-hour experiments ranged from 25 to 43%. Only two experiments with first-feeding larvae have been analyzed thus far. In these, 8% fed in one of the experiments and 52% fed in the other.

These results are part of a larger experiment devised by Dr. R. Lasker to ascertain the usefulness of anchovy larvae larger than 6 mm as tests for good larval feeding areas in the sea.

Condition of Ocean-Caught Larvae Evaluated for Assessment of Starvation

Considerable time has been devoted by Dr. C. O'Connell, Fishery Biologist, this month to sorting and measuring anchovy larvae from 64 samples collected on cruise 7603J aboard the research vessel Jordan for histological assessment of starvation in the ocean population. Larvae will be sectioned and stained and then evaluated in accordance with criteria already established from a study of laboratory-starved specimens.

The intention was to obtain larvae from a representative range of environmental conditions, and this was accomplished satisfactorily. Two-thirds of the samples were collected near shore in temperatures ranging from 13.1 to 15.6°C. Over half of these samples contained an abundance of anchovy larvae, while the remainder had moderate to low numbers. Only one near-shore sample was devoid of larvae. Abundance shows some degree of association with time of day but appears to be independent of temperature. The offshore samples tended to have low numbers of larvae, including several with no larvae. Temperature ranged a degree lower offshore (12.3 to 14.5°C), but again there was no apparent relation of abundance and temperature within the group. Two offshore samples did contain moderate numbers of larvae. One was from Cortes Bank, and the other was from relatively cool water (12.7°).

Other parameters, such as size of larvae and plankton characteristics, also differed widely among the samples. Considering their variability, the cruise collection should suggest the incidence of starving and emaciated larvae in the population.

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The paper by Pritchard, Hunter and Lasker titled "The relation between exercise and biochemical changes in red and white muscle and liver in the jack mackerel, Trachurus symmetricus" (1971, Fish. Bull. U.S. 69(2):379), has been honored by its inclusion in Readings in Ichthyology edited by Milton Love and Roger Caillet, in press. This is the second paper from the Southwest Fisheries Center honored by inclusion in textbooks of this kind. Last year, Dr. O'Connell's paper "The interrelation of biting and filtering in the feeding activity of the northern anchovy (Engraulis mordax)" (1972, J. Fish. Res. Bd. Canada 29:285) was included in Marine Ecology: Selected Readings, edited by Cobb and Harlin, University Park Press.

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Dr. Edward Scura, Physiologist presently at the Honolulu Laboratory, at the request and expense of the Institute of Marine Research, Bergen, Norway, has been assisting their larval fish group in preparation for a cruise to the Lofoten area, famous for cod spawning. Dr. Scura is providing expertise developed with Dr. Lasker at the Southwest Fisheries Center to a ship-board experiment utilizing first-feeding cod larvae to determine where the best larval fish feeding grounds exist. Dr. Scura is expected back by mid-May.

Growth in Recent Sample of Field-Caught Larvae Exceeds that of Laboratory Fish

Fishery Biologist David Kramer reported that studies of growth rates of anchovy larvae as determined from daily increments in their otoliths were begun this month on samples collected on a cruise aboard the Jordan in March 1977 in the Southern California Bight, inshore near Newport Beach. Sea surface temperatures in the area ranged from 13.0 to 15.0°C.

In one sample, collected at 15.1°C, the larvae grew faster than that of laboratory animals grown at the same temperature. This is the first time growth of field-caught larvae has exceeded that of laboratory-grown larvae. In general, growth of sea-caught larvae has been less than that of laboratory grown specimens. This accelerated rate persisted from the smallest (5 mm) to the largest larvae examined so far (14 mm). This rate was much faster than those taken in the same area in March 1976. Larvae in two samples taken at 15.0 to 15.8°C in 1976 grew slower than laboratory animals and showed a drop in growth rate after they reach 10 mm. Their growth rate was less than that of larvae reared at 14°C in the laboratory.

Study of Starvation in Jack Mackerel Larvae Continues

Ms. Gail Theilacker, Fishery Biologist at the La Jolla Laboratory, continued to study starvation in jack mackerel larvae. During the initial phase of the work with laboratory-reared larvae, histological criteria developed for assessing larval nutritional condition were used successfully to identify fed larvae and larvae starved for 3 days after yolk absorption. The results of the histological classification of larvae starved 1 and 2 days after yolk absorption, however, were variable. The analysis suggested that about a third of the 1- and 2-day starved larvae were healthy and capable of feeding and a third was irreversibly starved. The remaining group exhibited some tissue degeneration but no severe nuclear damage (darkening and shrinking of nuclei, pyknosis gives the first indication that a cell is dying). Additional laboratory experiments are required to 1) determine whether the tissue degeneration is reversible if the larvae feed when exposed to food after the initial period of starvation, 2) correlate tissue degeneration and regeneration (if applicable) with survival, 3) determine larval survival when feeding is delayed 1 and 2 days after yolk absorption, and 4) assess survival of larvae starved for 1 or more days after an initial period of feeding. Once there is an understanding of the histological processes occurring during periods of starvation, histological criteria can be developed which will be useful for estimating larval survival in the field by assessing the condition of sea-caught larvae.

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Ms. Theilacker joined two cruises on the NOAA research vessel Jordan this month to collect jack mackerel eggs to rear the larvae and study starvation. The area searched ranged between San Diego and Santa Monica and extended 220 miles westward. A few eggs were collected in one tow 210 miles off San Diego. Further searching in the area proved fruitless. No other positive stations were made. Searching will continue during two cruises scheduled next month.

Ms. Theilacker completed a manuscript this month entitled "Effect of starvation on the histological and morphological characteristics of jack mackerel larvae, Trachurus symmetricus." The paper has been sent out for review and comment.

Draft Manuscript Completed on Depth Distribution
and Abundance of the Chaetognath, *S. scrippsae*
in the California Current

At the La Jolla Laboratory Dr. A. Alvarino, Fishery Biologist, reports that she has finished a draft manuscript on the depth distribution and abundance of the chaetognath, *Sagitta scrippsae*, Alvarino 1962 in the California Current off California and Baja California. She has also prepared tables of the depth distribution of chaetognaths off the California coast. This analysis is of value in the assessment of the importance of chaetognaths as predators of larval fishes. She noted that large species of *S. hexaptera*, *S. enflata*, and *S. scrippsae* had the highest incidence of larval fishes in their stomachs but few or no fish larvae of the same species were present in the same plankton sample. She also observed that larger, more developed larvae, occurred more frequently in the stomachs than younger ones and no larvae in the yolk-sac stage were found. Two of the species with high incidence of fish larvae in their stomachs, *S. hexaptera*, *S. enflata* are most abundant in the upper 25 and 50 m.

Preliminary Data Indicate Sensitivity of
Anchovy Larvae to UV Radiation

Dr. Hunter reports that two successful threshold experiments on effects of UV radiation on survival of larvae of Pacific mackerel and anchovy were completed using the roof-top aquarium. In addition, construction of an apparatus in the aquarium for measuring UV effects on fish larvae was completed. Calibration of this second apparatus will begin when UV lamps have aged an appropriate time. The preliminary data on UV threshold indicate that anchovy larvae are about twice as sensitive to UV radiation as mackerel. This could possibly reflect differences in depth distribution, but existing vertical distribution data is not sufficiently precise to test this hypothesis. Both species are most abundant in the upper 20 m.

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An investigation of microstratification by Dr. R. Owen, Oceanographer at the La Jolla Laboratory, and Mr. R. Ando conducted during the March cruise of the research vessel *Jordan* yielded two sets of replicate samples now being processed to extract least significant differences (error estimate) among concentrations of small zooplankton, phytoplankton, particles, plant pigments and nutrients, all measured without replication on previous cruises. These estimates will permit then to distinguish variation due to sampling and analysis error from variation attributable to real differences in concentration between samples as little as 20 cm apart.

Mr. Ando, working with Dr. Owen, continued his development of techniques for optical measurement of microdistribution of particle concentrations and simultaneous measurement of small-scale physical discontinuities and has prepared a research proposal to investigate physical processes by which biological microdistributions are formed and destroyed.

Data From Fish Egg and Larva
Surveys Analyzed

Mr. James Zweifel, Mathematician at the La Jolla Laboratory, has completed a detailed description of his work on the analysis of data from fish egg and larva surveys. In the analysis, all counts are weighted according to 1) the volume of water strained, 2) extrusion through the meshes, 3) length of time spent in the size interval as a function of temperature and 4) avoidance of the net. Weights are applied individually rather than en masse and parameter estimates are obtained assuming an underlying negative binomial distribution. A mortality curve has been estimated by using the exponential decay curve to define the relationship between the standardized group means as a function of age. The parameters of the decay curve (N_0 , p) and the contagion coefficients (K) are obtained simultaneously as the maximum likelihood solution for the entire size range included in the analysis. The table on the following page shows that for the combined samples from 1969 for the central subpopulation of northern anchovies the estimated daily mortality rate is 23% per day. Ninety-five percent confidence limits can be estimated for any point along this curve. Similar analyses are underway for both seasonal (quarterly) and annual estimates of abundance and mortality for each year in which data are available.

MULTISPECIES TAXONOMY PROGRAM

Nigerian Scientist to Study Identification of Fish
Eggs and Larvae During 6-Month Stay at Center

Ms. Olayinka Babalola of Nigeria arrived at the La Jolla Laboratory on April 20 to spend 6 months studying the identification and collection of fish eggs and larvae with Senior Scientist Elbert Ahlstrom and the staff of the Multispecies Taxonomy program at the La Jolla Laboratory. Ms. Babalola brought some samples with her from Nigeria for study, but will also study the Laboratory's collection of fish eggs and larvae. She plans to make a trip aboard the David Starr Jordan to obtain first-hand background information on the Laboratory's sampling techniques and gear.

Beginning April 25, Ms. Beverly Vintner of the Northwest Fisheries Center, Seattle, Washington, spent 2 weeks with the group learning techniques for illustrating fish eggs and larvae. Ms. Vintner worked closely with Barbara Sumida during her visit.

* * * * *

On April 29, Arthur Kendall of the NMFS Laboratory at Sandy Point successfully defended his Ph.D. dissertation at the University of California, San Diego. The title of his thesis is, "Relationships among American seranid fishes based on the morphology of their larvae." Dr. Ahlstrom was co-chairman with Dr. Richard Rosenblatt of Kendall's Ph.D. Committee at the Scripps Institution of Oceanography.

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Number of anchovy larvae (under 4 m^2) estimated for each size interval (MHAT) and from a common mortality curve (ESTM).
 Confidence intervals and S.E.'s are estimated using the constant instantaneous rate of mortality (p).

SIZE	AGE	MHAT	ESTM	S.E.	LOWER	UPPER	KHAT	S.E.	N
2.50000	3.44120	138.59053	127.62905	0.12453	100.00115	162.89251	0.06751	0.00399	963
3.75000	6.57153	61.54475	56.43078	0.11341	45.18900	70.47179	0.08136	0.00477	963
4.75000	9.75304	24.90223	24.62000	0.10933	19.87395	30.50201	0.08768	0.00529	963
5.75000	11.89179	11.30493	14.09696	0.10361	11.50805	17.27083	0.09790	0.00614	963
6.75000	13.91903	7.82038	8.30979	0.09393	6.91404	9.98980	0.11991	0.00777	963
7.75000	15.87644	4.78509	4.98840	0.08955	4.18664	5.94617	0.13347	0.00925	963
8.75000	17.74826	3.15453	3.06213	0.08807	2.57774	3.64001	0.14051	0.01066	963
9.75000	19.55948	1.94352	1.90962	0.08441	1.61946	2.25422	0.15831	0.01346	963
10.75000	21.32901	1.33810	1.20390	0.09174	1.00672	1.44217	0.13798	0.01412	963
11.75000	23.07194	0.76165	0.76427	0.10682	0.62080	0.94344	0.10381	0.01351	963
12.75000	24.80089	0.49018	0.48695	0.11935	0.38625	0.61653	0.08622	0.01309	963
13.75000	26.52688	0.30408	0.31050	0.14578	0.23414	0.41451	0.05847	0.01078	963
14.75000	28.26000	0.20995	0.19762	0.14037	0.15089	0.26153	0.07230	0.01523	963
15.75000	30.00985	0.10225	0.12523	0.15322	0.09352	0.17047	0.06874	0.02047	963
17.25000	30.81334	0.10853	0.10156	0.14135	0.07778	0.13533	0.10637	0.03097	963

$N0 = 313.02745$ $S.E. = 23.73795$
 $B = 0.2671$ $S.E. = 0.00404$
 $COV = 0.08890$
 95% LIMITS FOR THE NUMBER OF NEWLY HATCHED LARVAE
 (AGE = 2.38 DAYS) IS
 $131.87623 < 168.30817 < 214.80740$

Dr. Ahlstrom, Leader of the Multispecies Taxonomy program, reports that work continued on two manuscripts, one dealing with pigmented flatfish larvae, the other with the rockfish, Sebastes melanostomus. The latter has an extended pelagic early juvenile stage in mid-depths.

* * * * *

A major function of the staff of the Multispecies Taxonomy group is the identification of fish eggs and larvae from the CalCOFI survey collection. Dr. Ahlstrom reported this month that efforts of his staff to reduce the backlog of unidentified CalCOFI samples to zero before the beginning of the next CalCOFI year is progressing well.

SURVEY SYSTEMS DEVELOPMENT AND EVALUATION PROGRAM

Time-Series Atlas of CalCOFI Oceanographic Data in Preparation

A 16-year time series of oceanographic data, prepared by Mr. L. Eber, Oceanographer at the La Jolla Laboratory, from the upper 200 m for 23 selected stations in the California Current region has been accepted for publication in the CalCOFI Atlas series. The data will be presented in a set of computer-drawn plots which contain isopleths of temperature, salinity, oxygen and sigma-t (density) in sections representing depth vs. time. The isopleths were computed from values of the oceanographic variables interpolated to standard depths. Subsequently, a procedure suggested by the Atlas editors to indicate the actual locations of observed depths in the plots was implemented through computer program modifications, which made it possible to extract and plot the observed depths on underlay sheets for transfer to the master charts. This work, along with the application of shading, cutting in of strip plots for isolated stations and final touch-up is being carried out by the SIO-MLR illustration group.

Temperature Summaries Tabulated for CalCOFI Pooling Regions

Sea water temperatures at six depths (0, 10, 30, 50, 100 and 200 m) have been summarized and tabulated by cruise for each of the 24 regions defined for pooling biological (egg and larval) data obtained during CalCOFI cruises during the period 1950 through 1968.

Along with the mean values, the tabulations give the standard deviation of temperature by cruise for each region, the number of stations occupied and the mean date of occupancy. Also included are the long-term monthly means for each region and the average annual mean.

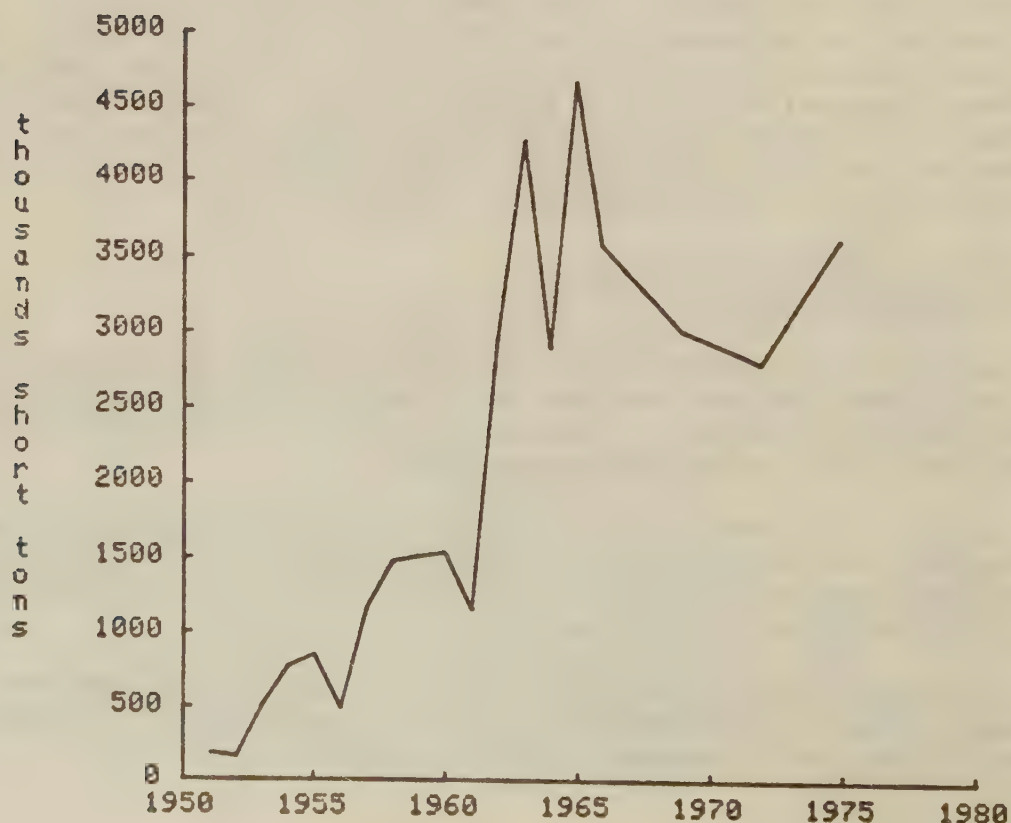
The tabulations were produced by O. Burris, Computer Programmer of the ADP Unit at the La Jolla Laboratory, from the regional file of CalCOFI oceanographic station data completed in the first quarter of FY 1977.

Northern Anchovy Spawning Biomass of Central Stock
Estimated at 3.6 Million Short Tons

The entire CalCOFI 1975 survey material has been sorted for fish eggs and larvae, on schedule, by the Scripps Institution of Oceanography Biomass Laboratory on contract to the California Marine Research Committee and the National Marine Fisheries Service. The central stock spawning biomass estimate is the first of several reports on the survey data. The central stock is currently the object of a binational fishery (U.S. and Mexico).

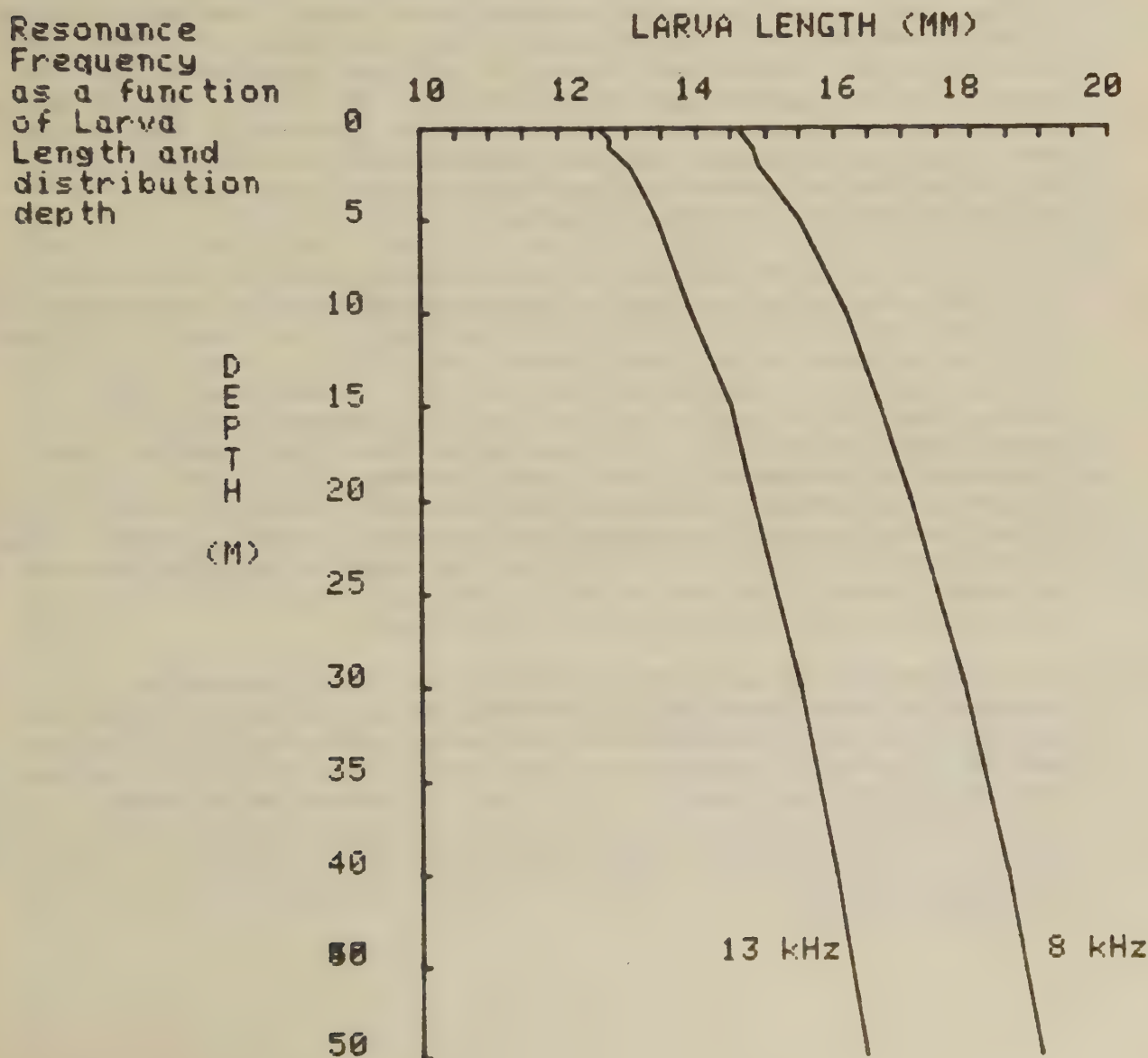
Dr. Smith reports that the 1975 estimated spawning biomass is 3.6 million short tons (3.24 million metric tons). It is the highest since 1965 and the third highest on record after the years 1965 and 1963. The central stock has been at and above the 3 million-ton mark since 1962. The anchovy had undergone a sustained increase in the preceding decade from below 200,000 tons in 1952 and passed a million tons in 1957; their stock estimates are 4.1, 6.1 and 5.2 million metric tons for the 3 years respectively. The Soviet acoustic surveys in December 1974 and January 1975 yielded an estimate of 6.5 million metric tons. This estimate probably included the central and southern stocks of anchovy and also included aggregations of non-spawning fish. Oregon State University is preparing spawning biomass estimates of the northern stock for 1975 and 1976. An acoustic survey is also planned for that area in 1977.

Anchovy Spawning Biomass Central Stock



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Analysis of the March cruise resonance frequency data by Dr. Van Holliday of Tracor, Inc. and Dr. Paul Smith, Fishery Biologist at the La Jolla Laboratory, revealed two peaks of return. The resonance between 1 and 3 kHz (thousands of cycles per second) is attributed to the adult anchovies in that size group sampled from the work area and another broad peak of resonant back-scattered energy between 8 and 13 kHz. Tables prepared by Dr. Holliday and measurements of field-caught larvae by Fishery Biologist John Hunter allow a preliminary projection of the size of larva involved in the resonant peak. Since depth has not been resolved, Figure 1 is a graph of resonance frequencies at the extremes of the peak, 8 to 13 kHz. Peak return in the near surface region would be interpreted as 13.5 mm kHz. larvae.



COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH
FOR MANAGEMENT PROGRAM (CRFRM)

Optimum Yield Model for Anchovy Management Revised

Revisions and extensions to the optimum yield model for anchovy management were made during April by Alec MacCall, California Fish and Game Biologist, and Dr. Dan Huppert, Leader of the Commercial and Recreational Fisheries Research for Management Program. The dynamic programming model, completed in March, is designed to compute the harvest policy maximizing the expected total catch of the fishery over 40 years. The concept of "optimum" embedded in this mathematical model recognizes biological variability of the fish stock in the sense that a wide distribution of possible outcomes are specified for any given stock size/harvest rate combination. Each possible outcome is given a probability from a log-normal distribution function. In short, the optimal policy under these conditions can be expressed as a rule for assigning a yearly harvest rate. The rule calls for a zero harvest when the anchovy stock is less than about 1.5 million metric tons in biomass. The optimal harvest is increased by about 1.3 tons for every ton of biomass in excess of 1.5 million. This policy appears to have reasonable characteristics. A minimum reserve stock of 1.5 million tons should protect the fishery from over-exploitation; the increasing harvest with increasing biomass allows the fishing fleet to reap the benefits of biomass in excess of the reserve stock.

During April, the variance of harvest and populations was investigated by use of a Markov model. The question posed is this: If anchovy biomass fluctuates widely and independently of the fishery, then what is the expected value and variance of the yearly harvest under a policy which is sensitive to fish biomass? To investigate this question, a transition probability that a given initial population (row) will, after one year, result in a given population (column). As is generally true of such matrices, the eigenvector corresponding to the eigenvalue of 1.0 is a stationary probability distribution, representing the probabilities of observing the population levels under the prescribed harvest policy. This stationary probability distribution is used to calculate the expected value and variance of the annual harvest, and the probability that the biomass will fall below the minimum size of 1.5 million tons in any year.

For the optimal policy prescribed by the dynamic programming model, the expected annual catch is 520,000 tons, but the probability that the population will fall below minimum reserve stock size is 66%. This means that the fishery is expected to be shut down 2 years out of 3. Implicitly, the catch during years when fishing is not prohibited should average about 1.56 million tons. The policy, therefore, is essentially an "on-off" policy; the "on" is a tremendously large annual catch and the "off" is a moratorium on fishing. For economic and social reasons, such a policy could not be considered optimal.

In an effort to define and compute optimal yield for the anchovy fishery, MacCall and Huppert are now developing a method for evaluating the trade off between mean harvest and variability. There is no way to assure a reasonably large average catch without introducing some chance of a fishery moratorium so long as the minimum reserve stock concept is retained. The higher the average catch, the greater will be the frequency of fishery shutdowns.

Preparation of Anchovy Management Plan Continues

Dr. Gary Stauffer, Fishery Biologist, continued work on the Anchovy Management Plan being prepared for the Pacific Fisheries Management Council. His major efforts were directed towards preparing the documentation on the life history and biology of the central subpopulation of the northern anchovy. Topics included in the literature review are distribution and movement, age and growth, seasonal fat cycle, mortality and reproduction. The latter includes fecundity, age at first maturity, spawning frequency and differential sex ratios in the area of the commercial fishery. An interesting finding was the low oil yield from the 1976 to 1977 reduction fishery. Generally, the fat cycle is low in the winter and spring yielding 2 to 4 gallons of oil per ton of anchovies and high in late summer and fall yielding about 13 to 18 gallons per ton. Records from the reduction fishery for the fall of 1976 show that the oil yield was about 50% below the average for October, 40% below for November, and 25% below for December. The reason for these low oil yields is not known, but one hypothesis is that the anchovies may have spawned much earlier than normal as a result of the above normal water temperatures in the Southern California Bight during this period.

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Keith Parker, Statistician, finished the first draft of an appendix to the Anchovy Management Plan in which he reviews and evaluates the method of estimating anchovy spawner biomass. The three main topics discussed are: 1) larval abundance estimation, 2) anchovy spawner biomass estimation, and 3) a review of the assumptions used and their possible effect on the spawner biomass estimate.

Rockfish

John MacGregor, Fishery Biologist at the La Jolla Laboratory, completed a 5-day cruise aboard the research vessel Jordan on April 1 to collect rockfish samples and has begun processing the samples for age and growth information. The preliminary data of interest is the composition of the rockfish catch from Tanner Bank:

<u>Species</u>	<u>% of catch</u>
Rosy rockfish	55
Olive rockfish	20
Starry rockfish	10
Blue rockfish	8
Honeycomb rockfish	5
Treefish	1
Bocaccio	1

The bocaccio, which is the most abundant species reported in the sport-fishery in southern California, comprised less than 1% of the catch at Tanner Bank. The rosy rockfish, which made up 55% of the Tanner Bank catch, is not reported as a significant species in the sport catch for southern California. This is perhaps owed to the fact that it is a small species generally discarded by sport fishermen.

MULTISPECIES COASTAL E. PACIFIC (CalCOFI) PROGRAM

U.S.-U.S.S.R. Cooperative Pacific Hake Survey Completed for 1977

The U.S.-U.S.S.R. cooperative ichthyoplankton survey with the Soviet research vessel Ogon was successfully completed on April 14. The objective of the survey was to collect ichthyoplankton samples at predescribed CalCOFI stations for obtaining an index of abundance of the spawning population of Pacific hake and northern anchovy. Biologist Robert Counts and Technician William Flerx returned to the SWFC, La Jolla, on April 14 after 38 days at sea. As reported last month, shipboard scan of the plankton samples indicated that hake eggs and larvae were present in a large percentage of the samples and occurred in greater numbers than in 1976. Mexico approved the Soviet Union's request to survey inside Mexico's 200-mile zone. As a result, the Ogon initiated the Mexico segment of the survey in the first week of April. Twenty-two plankton tows were made along lines 97, 100, 107 and 110. A few larvae were found only at three stations on line 97. Since the peak of hake spawning is usually in February and March, scarcity of hake larvae in April is not unexpected. A report on the index of abundance of hake in 1977 will be prepared as soon as the samples are sorted and the hake larvae are measured and counted. These numbers are critical for the setting of the 1977 catch quotas and foreign allowable levels of fishing for which NMFS headquarters has requested a mid-June deadline.

Differences in Heart Size Noted Among Laboratory-Grown and Ocean-Caught Anchovy Larvae

While examining bodies of ocean-caught and laboratory-grown anchovy larvae, side by side, Dr. David K. Arthur, NRC/NOAA Research Associate at the La Jolla Laboratory, noted that laboratory-grown larvae have much larger hearts per unit body length. The heart of the average 10 mm laboratory-grown larva has a volume 2.7 times that of the average ocean-caught larva. Differences in heart size diminishes in older larvae.

Dr. Arthur has completed a manuscript, including photographs of intact and excised hearts, which will soon be submitted for publication. This paper describes the difference in heart size and relates this difference to other morphological and apparent behavioral differences between ocean-caught and laboratory-grown larvae.

Oceanic Fisheries Resources Division

PORPOISE/TUNA INTERACTION PROGRAM

Porpoise Tagging Workshop Held at the Southwest Fisheries Center

A Porpoise Tagging Workshop, chaired by Ms. J. Jennings of the La Jolla Laboratory, was held on May 4 to 5 at the Southwest Fisheries Center. The workshop was cooperatively sponsored by the National Marine Fisheries Service, Marine Mammal Commission and Fish and Wildlife Service. In view of plans for a major porpoise tagging effort by the SWFC this fall, it was deemed advisable to convene the workshop at this time rather than to wait for the comprehensive marine mammal marking and tagging workshop scheduled for December 1977.

The objectives of the workshop were to review the state-of-the-art of tagging and marking small cetaceans, to assemble design criteria for improved tags and marks, and to identify specific areas of research needed for tag and mark evaluation and experimental design. All major programs involving the tagging or marking of porpoises were represented at the workshop.

It was concluded that all existing tags (none of which were developed for marine mammals) had significant inherent problems which made their use inadvisable, especially in as massive a tagging program as the one planned by the SWFC, until research and development on tagging and marking is conducted. Major problems with tags such as the standard dart-spaghetti tag and roto-tag are shedding, rejection, and migration of the tags. Marking techniques including freeze-branding are still experimental and must be studied to determine the temperature and pressure parameters to assure longevity of the marks. Techniques must be developed which are feasible for field operations.

A list of recommendations is being assembled for areas or research to be funded by the Marine Mammal Commission. Partly as a result of the workshop the SWFC has decided to concentrate its efforts this fall on tag "r+d", including determining the shedding rates of the tags, and on "mini-experiments" aimed at determining school size and integrity. These are essential preliminary steps before undertaking a massive tagging effort.

TUNA RESOURCES PROGRAM

Data Acquisition System to be Upgraded at the La Jolla Laboratory

Richard Evans, Oceanographer at the La Jolla Laboratory, reports that plans have been completed and approval obtained for updating the data acquisition system of the Real-Time Environmental Data sub-task within the Laboratory. Presently, some 20,000 marine weather observations per month are received at the La Jolla Laboratory via a 100-word-per-minute (WPM) teletype line. These observations are punched on paper tape and then transferred to IBM cards. The resulting card deck is then hand edited before being sent by messenger to the Burroughs 6700 computer on the University of California, San Diego campus for processing.

The new system will employ a 1200-wpm teletype and a dedicated micro-processor to collect the data, edit it and record it on magnetic tape. At frequent intervals, the recorded data will be further edited using CRT terminals. Much of the computer processing now being done by the Burroughs 6700 will be done by the in-house micro-processor with only more complicated processing being referred to the Burroughs 6700 computer. Data will be transferred directly between the Burroughs 6700 and the micro-processor by means of a dedicated phone line.

The new system will allow incoming marine weather data to be: 1) processed much more rapidly and efficiently, 2) permit acquisition of data currently lost due to time constraints on the existing 100 wpm teletype line, and 3) allow collection of marine weather data from all of the world oceans if desired.

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A tabulation of published population dynamics parameters for all major Atlantic and Pacific tuna stocks was done by Norm Bartoo, Fishery Biologist. The purpose of the compilation was to provide best estimates of basic population dynamics parameters for the global tuna systems model.

PACIFIC ENVIRONMENTAL GROUP

OCEAN MODELING AND FORECASTING

Project Development Plan for DOMES Reviewed at Workshop

Mr. G. Seckel, Oceanographer with the Pacific Environmental Group at Monterey, attended a workshop near Seattle April 25 to 27 to review the Project Development Plan for the Deep Ocean Mining Experimental Studies (DOMES). DOMES is managed at the Pacific Marine Environmental Laboratory (PMEL) in Seattle under the MESA Program of the NOAA Environmental Research Laboratories. Mining companies are now beginning prototype mining tests with one test scheduled for the fall of this year, in the region near lat. 16°N and long. 126°W. DOMES is therefore passing from a phase of baseline studies to investigating the effects of actual mining operations both in the surface layers and at and near the ocean bottom. At the workshop the investigations planned for the coming mining tests were reviewed. Other workshop members were from the University of Washington, Oregon State University, Scripps Institution of Oceanography, the University of Delaware, the MESA Program Office, and PMEL.

The potential module mining area of concern lies in the tropical Pacific between lat. 5° and 20°N and long. 110° and 180°W. DOMES, therefore, is of interest to the NMFS because the mining area extends into eastern Pacific tuna fishing grounds. Also, the information generated by DOMES is adding to our understanding of the tuna environment.

During 1975 and 1976 baseline studies were conducted primarily by a number of academic institutions under DOMES contracts. A progress report (Preliminary Report, Deep Ocean Mining Environmental Study, Phase I) was published by PMEL in August 1976. It is expected that the university contractors will publish results of their investigations in the scientific literature. PMEL is planning to publish progress reports of the work annually. DOMES data are on file at PMEL.

Much background environmental information for the area was available from previous oceanographic surveys, of course, that were primarily conducted by the NMFS. New, however, are data from current meters moored near the mining test area. The resultant currents from 2 months of continuous observations have a strong northward component in the upper 100 m and an eastward component below 150 m. Characteristic of the area is the high stability in the thermocline (about 27°C at the surface and 12°C at 150 m) and very low oxygen concentration beginning at only 150 m. The current measurements show that there is a high current shear in the upper 100 m with resultant speeds of about 19cm/sec at 20 m and 6.5cm/sec at 100 m. D. Halpern reported at the Offshore Technology Conference in May 1976, that the vertical profile of geostrophic currents was not in agreement with the current meter measurements. These observations suggest that

the surface wind driven flow is an important part of the current field in the test area and probably also in the tuna fishing grounds of the tropical eastern Pacific.

TIBURON LABORATORY

NMFS Director Schoning Visits Tiburon

Mr. Robert W. Schoning, Director of the National Marine Fisheries Service, and Mr. Robert Ayers, Acting Assistant Director, Office of Fisheries Management, visited the Tiburon Laboratory on April 6. Mr. Schoning addressed a meeting of the entire staff and then responded to questions. He and Mr. Ayers also toured the Laboratory and observed research activities.

FISH COMMUNITIES INVESTIGATION

Contract for Sampling Rockfish Landings Awarded to California Department of Fish and Game

A \$24,000 contract was awarded to California Department of Fish and Game to sample rockfish landings between Monterey and the Oregon border. Under the contract, landings of rockfish by commercial fishermen and party-boat fishermen will be sampled for species, size, and age. This information is vital in developing plans to manage the rockfishes, as required under the Fishery Conservation and Management Act of 1976.

Investigation Task Leader Participates in Meeting of Pacific Fishery Management Council

Dr. William Lenarz, Leader of the Rockfish Analysis Task at the Tiburon Laboratory, traveled to Portland, Oregon, where he participated in the first meeting of the Groundfish Management Plan Development Team of the Pacific Fishery Management Council (PFMR). After electing Robert Demory of the Oregon Department of Fish and Wildlife as chairman, the team began developing a proposal for its work to be presented in June for approval of the PMFR. Much work lies ahead, as the team must produce plans to manage hake, sablefish, and many species of flatfishes and rockfishes.

Recovery of Groundfish Fillets Studied

Mr. Edward Ueber, Economist with the Rockfish Analysis Task at the Tiburon Laboratory, initiated a study of the recovery of groundfish fillets. Accompanied by Fishery Biologists Peter Adams, Tina Echeverria, and William Lenarz, Mr. Ueber visited the processing plant of Ocean Beauty Seafood at Sacramento on April 25. Here the group gathered data on recovery of the fillets from several size categories of chilipepper rockfish, shortspine rockfish, thornyhead rockfish, Dover sole, and petrale sole. The continuing project is designed to determine the effect of species, size, and season, on recovery. The task will use this information to evaluate alternative

management plans, and the industry is interested in it as a means to determine the value of landed fish. Several processors have offered the group access to their plants and records to expand the work.

Seasonal Occurrence of Algae on Nearshore Reefs Monitored

In their monitoring of the nearshore habitats at study sites near Albion, in northern California, Dr. Edmund Hobson, Leader of the Nearshore Recreational Fish Communities Task, and Fishery Biologist Tony Chess, found no evidence of the seasonal appearance of the Nereocystis beds that are predominant biological features of many reefs during most of the year. Extensive growths of this alga are expected to develop as soon as days grow longer and water temperatures rise. Although benthic algae in water deeper than 10 m showed little evidence of this season's growth, much current growth was found in the lush algae that carpeted the sea floor in less than 5 m of water.

FISHERIES DEVELOPMENT INVESTIGATION

Cooperative Euphausiid Fishery Trials Conducted off Monterey Bay

Mr. Susumu Kato, Leader of the Fisheries Development Investigations at Tiburon Laboratory, traveled to Moss Landing on three different occasions, April 12 to 13, April 15 to 16, and April 20 to 23, in attempts to catch and process euphausiids. During the two earlier trips rough weather prevented fishing, but on the third trip the seas in Monterey Bay finally allowed the experiment to proceed.

Fishing was conducted from the commercial troller/dragger Lady Olga, whose captain, Brent Bixler of Santa Barbara, agreed to work with NMFS without cost except for fuel. NMFS also provided the needed fishing gear.

The scattering layer was located with a depth recorder, and a frame trawl with a mouth of 8 by 10 ft was towed in the midst of the layer. A total of six tows (two per night) was made in three nights of fishing. The catch per night of Euphausia pacifica was 324 lbs, 1114 lbs, and 605 lbs. The catch was remarkably clean; only about 3 pounds of fishes, primarily myctophids, were caught incidentally.

The euphausiids were packed in one-pound trays and frozen at the facilities of Consolidated Factors at Moss Landing. The bulk of the catch will be shipped to Japan as a sample. They will be used as chum in both commercial and sport fisheries. If the product is acceptable, the immediate market in Japan is around 120 tons per year. Samples will also be distributed to local aquarium supply dealers who foresee a potentially larger market. Euphausiids are presently being used to feed aquarium fish, replacing the costlier brine shrimp. The present supply originates in British Columbia. Commercial feasibility of developing a euphausiid fishery here will depend on the seasonal abundance and catchability with a larger trawl.

Recreational Fisheries Improvement Task

Mr. Roger Green, Leader of the Recreational Fisheries Improvement Task at the Tiburon Laboratory, reported that the coho salmon now being pen-reared at Tiburon showed practically no growth this month despite normal appearing feeding behavior and low mortality. This particular batch of fish also showed very slow growth at the Mad River Hatchery where they were reared for over a year before reaching smolt size. The fish originated from eggs taken from the Skagit River, Washington. There is also the possibility that the dry pellet food has lost some of its nutritional value through overly long storage. An experiment is planned, feeding two small samples of fish the old food and fresh food of the same type, and noting differences in growth. Other fish growers have expressed interest in the outcome. Apparently nothing has been published on the effect of length of storage, food and its value for producing growth.

It was learned this month that the California Department of Fish and Game will be unable to supply fish for the next pen-rearing cycle at Tiburon this summer. A search is under way for commercial sources of coho salmon.

Work on the salmon-rearing facilities included installation of a salt-water pump, fabrication of small experimental nets, repair of nets and pens, and construction started on a floating fish trap modification of a floating net pen to trap returning mature salmon for artificial propagation.

A coho salmon tag from our 1975 release was returned by an angler fishing off of Santa Barbara. This is the southernmost tag return, thus far; the fish weighed 6-3/4 lbs. dressed out (viscera and gills removed).

PHYSIOLOGY INVESTIGATION

1977 Striped Bass Spawning Experiments Begin at Tiburon Laboratory

Dr. J. Whipple, Leader of the Striped Bass Task at the Tiburon Laboratory reported that the 1977 striped bass spawning and experimental season begun this month. Numerous samples of ripe ovaries were collected from the California Department of Fish and Game Hatchery and from anglers. These ovaries are being analyzed for various chemical components which relate to general metabolism and ultimately growth and survival. Initial sampling showed carbohydrate and lipid contents of eggs differed, depending on their location in the ovary. Mature ova in the ovarian lumen and oviduct contained more carbohydrates and less lipids than immature ova. Sampling procedures are being standardized for comparison between ovaries.

A successful spawning took place April 27 in which newly fertilized eggs were incubated and hatched in different water types representing various experimental, hatchery and wild situations. Water used came from the striped

bass hatchery well, Tiburon Laboratory fresh-water source, four Sacramento River and Delta areas, and four fresh-water/salt-water mixes (3, 6, 9, and 12 ppt). Each water type is presently being analyzed for physiologically important ions and heavy metals through a cooperative arrangement with the U.S. Bureau of Reclamation.

Preliminary results indicate high mortalities in all treatments. Electrophoretic examination of female tissues showed biochemical disorders possibly related to the poor survival. Nonetheless differential hatching success and abnormalities were seen among the survivors. Hatchery well water and Tiburon tap water had the poorest survival and natural river water from Sacramento had highest survival and lowest number of abnormalities. Behavior of newly hatched larvae also differed. Larvae in the higher salinity waters were noticeably more active and demonstrated escape responses.

Report on OCSEAP Petroleum Research Submitted

A report describing the activities and accomplishments of project personnel at the Tiburon Laboratory during the past year was prepared and sent to the OCS office of NOAA in Juneau. Included within this report was a finished first draft of a manuscript describing the oil solubilizer developed at the Tiburon Laboratory.

A series of planning sessions was held during the month to develop experimental designs for chronic exposure studies. The studies include the exposure of clams and flounder to the water-soluble fraction of Cook Inlet crude oil via the water column, food, or the water column and food. In addition, techniques were outlined for determining the rate of uptake of the water-soluble fraction by phytoplankton.

During the month, a series of mature flounder gonads was sent to the Northwest and Alaska Fisheries Center in Seattle for analysis. These tissue samples had been taken from fish exposed to low levels (approximately 100 ppb) of the water-soluble fraction and were to be analyzed primarily for aromatic compounds and metabolic by-products on the mass spectrometer. Arrangements were made to send numerous future samples to the Seattle facility.

Tom Yocom, Meryl Cohen, and Ross Smart completed a course in basic gas chromatography and were visited in Tiburon by the course instructors from Gulf South Research Institute who offered suggestions on gas chromatographic techniques for oil analyses.

Dr. Fred Weiss of the Shell Development Company and Dr. Jack Anderson of Battelle Northwest Laboratories visited the laboratory during April to discuss oil pollution experiments and analytical techniques.

HONORS AND AWARDS

Honolulu Laboratory

Dr. Jerry Wetherall, in the supervisory category, and Mr. Ray Sumida, in the non-supervisory category, were announced as nominees for Hawaii's Federal Employee of the Year.

Tiburon Laboratory

Mr. Lloyd Richards, Biological Technician, received a citation from the Tyee Club in appreciation for his services on the coho salmon-rearing project at Tiburon, which is conducted in cooperation with the Tyee Club, a sportfishing organization. Mr. Richards resigned from the Tiburon Laboratory April 24 to accept a position with the National Marine Fisheries Service, Alaska region.

PUBLIC RELATIONS

Honolulu Laboratory

On separate occasions, Mr. Shomura, Dr. Skillman and Dr. Roy Mendelssohn presented lectures to Dr. Tim Smith's Fisheries Science class at the University of Hawaii. Mr. Shomura lectured on the fisheries resources of the Pacific, particularly relating to the tunas and tunalike species; Dr. Skillman spoke on the cooperative study of the Northwestern Hawaiian Islands; and Dr. Mendelssohn talked about how optimal harvesting strategies become more complex as the models become more complex. Dr. Mendelssohn also presented a talk to a group at the Agricultural Economics Department at the University of Hawaii on multiobjective problems in fisheries.

Mr. Otsu provided information on the Northwestern Hawaiian Islands program to Mr. Bob Costa of the Honolulu Chamber of Commerce and Mr. Jaydee Hanson of the University of Hawaii.

La Jolla Laboratory

- April 20 - Mr. I. Barrett, Acting Center Director, attended the 23rd Annual Greater San Diego Science Fair in Balboa Park where he was invited to act as a judge in the Biology division.
- 21 - Fishery Biologist David Kramer was host to 22 participants in the San Diego Science and Engineering Fair. Mr. Kramer lectured the group on the work of the Center and later guided them on a tour of the facilities. This is the seventh consecutive year that Mr. Kramer has hosted Science Fair participants.

- April 22 - Mr. John Bascom and his class in ichthyology from Cal-Poly Institute, Pomona visited the Center. The visit was arranged by Drs. H.G. Moser and John Hunter who lectured to the group as did Dr. E. Ahlstrom and Mr. D. Kramer.
- 25 - A class from Sunset View Elementary School visited the Center with their instructor, Mr. Tom Ellsworth. Mrs. Betsy Stevens spoke to the group on the fisheries research program of the Center and later guided the group on a tour of the Center's facilities.
- 28 - Richard Evans, Oceanographer, presented a slide show to the San Diego Fish and Game Explorer post. The talk, which was given at the Girl Scout headquarters in Balboa Park, dealt with the research within the Southwest Fisheries Center and instruments used at sea for the collection of oceanographic data.



Mr. Roy Allen, Illustrator (shown at left), manning the Southwest Fisheries Center display at the University of California, San Diego's Earth Day, April 22, 1977. The focus of the fair was on the ecological contribution made to the environment at all levels of the community, including state and federal agencies. According to Mr. Ken Raymond, Scientific Illustrator at the Center, who created the display, an estimated 2,000 people visited the exhibit.

Tiburon Laboratory

- April 9 - Messrs. Norman Abramson and Susumu Kato arranged a trip on a local charter boat for Senor Fernando Rafful and his party on a tour of San Francisco Bay fishing and boating facilities. Senor Rafful is director of the Mexican Fisheries Department and had attended the Marine Recreational Fisheries Symposium in San Francisco.

SEMINARS

Honolulu Laboratory

- April 26 - Mr. Craig MacDonald, Graduate Student, University of Hawaii, spoke on "Biology and fishery of the spiny lobster, Panulirus marginatus, at the northern and southern limits of its range."

La Jolla Laboratory

- April 18 - Dr. Albert C. Myrick, Jr., Department of Earth Sciences, Vertebrate Paleontology Section, Los Angeles County Museum of Natural History, discussed, "The biology of the Eurhino-
delphidae of the Calvert formation."

Tiburon Laboratory

- April 1 - Dr. Victor L. Loosanoff presented the last talk of his series of mariculture seminars at Tiburon Laboratory. His topic was "Diseases, Predators and Competitors of Bivalve Molluscs."
- 14 - Michey Eldridge, Fishery Biologist, presented a seminar on larval fish physiology and energetics at the Moss Landing Marine Laboratory, Moss Landing, California.
- 15 - Dr. Joel Hedgepeth spoke on "A History of the Study of San Francisco Bay" at Tiburon Laboratory.
- 16 - Dr. Edmund Hobson presented a paper at a one-day environmental symposium for teachers at Scripps Institution of Oceanography. His topic was "Fishes in Southern California Kelp Forests and Other Nearshore Habitats."

TRAINING

- April 10-15 - Barbara Engstrand, Administrative Assistant at La Jolla, was in Seattle to attend a GSA Federal Supply Schedules course. and receive procurement training from the Field Finance office staff.

- April 11-12 - Nancy Wiley, Tiburon Laboratory, "Data Base Concepts," (Institute for Advanced Technology, Control Data Corp., Denver, Colorado).
- 13-15 - Nancy Wiley, Tiburon Laboratory, "Data Base STR & File Organization," (Control Data Corp., Denver, Colorado).
- 18 - Edward Ueber, Tiburon Laboratory, "Seafood Marketing Management Workshop, University of California at Davis, Davis, California.
- 25-27 - Thomas Yocom, Meryl Cohen, David Smart, Tiburon Laboratory, "Basic Gas Chromatography," Hewlett-Packard, Santa Clara, California.

VISITORS

Honolulu Laboratory

- April 1 - Mr. Koh Dong Jae, representative of the Republic of Korea in American Samoa.
- 8 - Dr. Charles O. Mather, International Billfish and Marine Foundation, Los Angeles, California.
- 11 - Donald Morris, OICC Trident, Bremerton, Washington.
- 14 - Dr. Daniel P. Cheney, Resource Planning Inc., Hilo, Hawaii.
- Keith Coburn, Typhoon, San Diego, California.
- William H. Michael, Joann Marie, San Diego, California.
- Candace Turner and F.M. Hubbard, NASO, Seattle, Washington.
- 18 - Cdr. Edward M. Gelb, PMC, Seattle, Washington, together with Cdr. Lawrence E. Keister, Cromwell, and Cdr. A. Y. Bryson, Cromwell.
- 22 - Mr. B. G. Thompson, NMFS, Washington, D.C.

La Jolla Laboratory

- April 1-3 - Dr. Eric Bertelsen, University of Copenhagen, Copenhagen, Denmark. Visited Dr. E. Ahlstrom and staff to examine specimens of Gigantactis.
- Dr. Robert J. Lavenberg, Los Angeles County Museum.

- April 4 - A small working group which included Dr. Gary Sakagawa of the La Jolla Laboratory, Dr. Grant Beardsley and Mr. James Zuboy of the NMFS Southeast Fisheries Center, Mr. Richard Stone, Deputy Assistant Director for Recreational Fisheries and Mr. Robert Otto of NMFS, Washington met at the Center to discuss analysis of billfish data. The above-named are part of a larger task force which has been asked to pursue further the re-evaluation and analysis of available data concerning marlin and billfishes for the purpose of re-writing the status of stocks sections for the draft Environmental Impact Statement/Preliminary Management Plans.
- 11 - Mr. Gary Smith of the SW Regional Office at Center met with David Mackett, Program Planning Officer.
- 12 - Mr. Mel Odemar, California Department of Fish and Game at the Center consulted with Mr. David Mackett.
- Mr. Floyd Anders, Deputy Regional Director, at the Center met with Mr. Barrett.
- 14 - Dr. James F. Black, Scientific Advisor, Exxon Research and Engineering Co., to consult with SWFC staff members concerning long-range weather trends.
- 19-20 - Robert Wolf, NMFS Washington and Cdr. Merritt Walter, National Ocean Survey, Washington here for discussions concerning refurbishment of the NOAA research vessel David Starr Jordan.
- 20 - Henry Shire, National Ocean Survey, Pacific Marine Center.
- Mr. Richard Wilhelmsen, Pacific OCS Office, Bureau of Land Management, Los Angeles, California.
- Mr. Don Keene, Bureau of Land Management, Los Angeles, California.

Pacific Environmental Group

- April 11 - Robert Huffer, Scripps Institution of Oceanography, La Jolla, California.
- Steve Pazen, Scripps Institution of Oceanography, La Jolla, California.
- Jim Hardwick, California Fish and Game.

Tiburon Laboratory

- April 5 - Grant Beardsley, NMFS, SWFC, Miami, Florida.

- April 6 - Robert W. Schoning, NMFS, Washington, D.C.
 - Robert J. Ayers, NMFS, Washington, D.C.
- 8 - Richard Stone, NMFS, Washington, D.C.
 - Donald A. Wickham, NMFS, Washington, D.C.
 - David G. Deuel, NMFS, Narragansett, Rhode Island.
 - R. B. Thompson, NMFS, Northwest Regional Office, Seattle,
 Washington.
- 11 - Naoki Kato, Meltetsu, Inc., San Francisco, California.
 - Robert Huffer, Scripps Institution of Oceanography,
 La Jolla, California.
- 12 - Robert Wong, Association of Bay Area Governments, Berkeley,
 California.
 - Arthur Flechsig, University of California Cooperative
 Extension, San Diego Marine Advisor.
- 15 - Ralph C. Reeder, NOAA Rockville, Maryland.
 - Dick Heimann, California Fish and Game, Menlo Park, California.
 - James Carlton, Department of Geology, University of California
 at Davis, Davis, California.
 - Paul N. Reilly, California Fish and Game, Menlo Park, California.
 - Phil Swartzell, California Fish and Game, Menlo Park, California.
 - Rolf Mall, California Fish and Game, Long Beach, California.
 - Phil Schaeffer, National Audubon Society, Tiburon, California.
 - Clark Blunt, California Fish and Game, Sacramento, California.
- 26 - Dave Mackett, SWFC, La Jolla, California.
- 28 - Arthur W. Hasetine, California Fish and Game, Monterey,
 California.
- 29 - Scott Hennessy, Garrapata Fisheries, Carmel, California.

MEETINGS AND TRAVEL

Acting Center Director Izadore Barrett, senior scientists on his staff and representatives from the California Department of Fish and Game were hosts to Lic. Fernando Rafful, Head of the Mexico Department of Fisheries, Lic. Arturo Diaz Rojo, Adviser for special affairs, other high fishery officials of the Mexican government, and industrialists on April 4 at the Center.

Mr. Barrett was the spokesman during the informal meeting which covered such topics as the Fishery Conservation and Management Act, Management Plan development processes, and the strong need for continued cooperative research with Mexico on fish stocks of mutual interest in the California Current. According to Mr. Barrett, the meeting provided a unique opportunity to exchange views with top Mexican fishery officials.

March 30 -
April

- Messrs. Barrett and Mackett traveled to Apple Valley, California to attend the Southwest Region Management meeting.

April 3-6 - Mr. Shomura met with NMFS personnel at the Southwest Fisheries Center to discuss billfish data and albacore research.

5-7 - Fishery Biologist James Squire of the La Jolla Laboratory traveled to San Francisco to attend the Marine Recreational Fisheries Symposium.

6-7 - Norman Abramson, Susan E. Smith, Roger Green and Ed Ueber, Tiburon Laboratory, attended the Marine Recreational Fisheries Symposium held in San Francisco.

11 - Mr. Shomura met with Adm. Eugene A. Taylor, Director, Pacific Marine Center, NOS, Seattle, to discuss matters pertaining to Townsend Cromwell.

12 - Mr. Shomura met with Mrs. Godfrey, Mr. Heeny Yuen and Lt. Ted Kaiser to review last year's open house for ideas on how to improve this year's festivities.

- CalCOFI meeting at the Center. Attended by Messrs. Lasker, Hunter and Smith.

- Ed Ueber, Tiburon Laboratory, traveled to Sacramento to visit the Ocean Beauty Seafood plant with reference to fish fillet-yield experiments.

12-13 - Acting Center Director I. Barrett was in Washington, D.C. to discuss scientific and administrative matters with the staff of the Central Office.

- April 12-13 - Susumu Kato, Tiburon Laboratory, traveled to Moss Landing on
15-16 three occasions to attempt to catch and process Euphausiid
20-23 shrimps. During the first two trips rough weather prevented
fishing, but on the third trip a ton of Euphausiids was
caught from the F/V Lady Olga and processed for shipment to
Japan for bait in the Japanese commercial and sport fisheries.
- 13 - Mr. Shomura met with Dr. Skillman and Messrs. Yuen and
Sumida to discuss billfish data.
- Mr. Shomura met with Cdr. Merritt N. Walter and Herman W.
Frome 3d of Office of Fleet Operations, NOS, Rockville,
Maryland, to discuss Cromwell refurbishing.
- 14 - Mickey Eldridge, Tiburon Laboratory, traveled to the Moss
Landing Laboratory, Moss Landing, California to present a
seminar on larval fish physiology and energetics.
- 16 - Dr. Edmund Hobson, Fishery Biologist at the Tiburon Laboratory,
traveled to La Jolla where he gave a talk on reef fishes of
southern California at a symposium for teachers presented by
the Scripps Institution of Oceanography.
- Mickey Eldridge and Mike Bowers, Tiburon Laboratory, traveled
to California Fish and Game's Elk Grove hatchery for the first
striped bass spawning of the season.
- 18 - Dr. William Lenarz traveled to Portland, Oregon where he
participated in the first meeting of the Groundfish Management
Plan Development Team of the Pacific Fishery Management
Council.
- 21 - Mickey Eldridge, Tiburon Laboratory, traveled to California
Fish and Game's Elk Grove hatchery to obtain live striped
bass larvae for use in a feeding experiment.
- 18-22 - Dr. Gary Sakagawa, La Jolla Laboratory, traveled to the NMFS
laboratory at Beaufort, North Carolina, to discuss quanti-
tative population dynamics techniques with the staff.
- 19-23 - Mr. Shomura attended the WPRFMC meeting in Pago Pago, American
Samoa. Mr. Stsu served as Acting Laboratory Director.
- 20-22 - Dr. R. Lasker of the La Jolla Laboratory attended a post-IDOE
planning workshop in Kingston, Rhode Island where he was
the Ocean Sciences Board representative for Biological
Oceanography.

- April 21 - Dr. Edmund Hobson and Tony Chess traveled to Albion, California to check on the spring development of algae which characterizes the inshore habitats.
- 22 - Pete Benville and Meryl Cohen, Tiburon Laboratory, visited the California Maritime Academy of Vallejo, California to collect water samples.
- 25-28 - Acting Center Director I. Barrett and W. Fox, Acting Deputy Center Director, traveled to Mexico City to attend bilateral fisheries meetings.
- John Everett, Porpoise/Tuna Program Manager was in Ann Arbor, Michigan to attend the International Conference on Remote Sensing of the Environment at the University of Michigan.
- 26-28 - Dr. R. M. Laurs, Leader of the Albacore Fisheries program at the La Jolla Laboratory, traveled to Redwood City to meet with scientists of the National Environmental Satellite Service.
- 27 - Dr. Jeannette Whipple, Mickey Eldridge and Mike Bowers, Tiburon Laboratory, traveled to California Fish and Game's Elk Grove hatchery for the striped-bass spawning.

PERSONNEL

Honolulu Laboratory

- April 19 - William S. Lovejoy, Operations Research Analyst - 700 hr. Temporary Appointment.
- 24 - Stephen K. Fitzgerald, Library Assistant - converted from a 30-day to a 700 hr. Part-Time Temporary Appointment.

La Jolla Laboratory

- April 10 - James Coe, Fishery Biologist - Promotion.
- Robert Butler, Computer Programmer - Promotion.
- 11 - Dennis King, Industry Economist - EOD.
- 18 - Paul Nelms, Physical Science Aid - EOD.
- 24 - Charles Oliver, Computer Specialist - Promotion.

Tiburon Laboratory

- April 4 - Constance J. Ryan, Biological Aid - Temporary Appointment.
- 24 - Lloyd D. Richards, Biological Technician - Transfer to NMFS
Alaska Region.

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